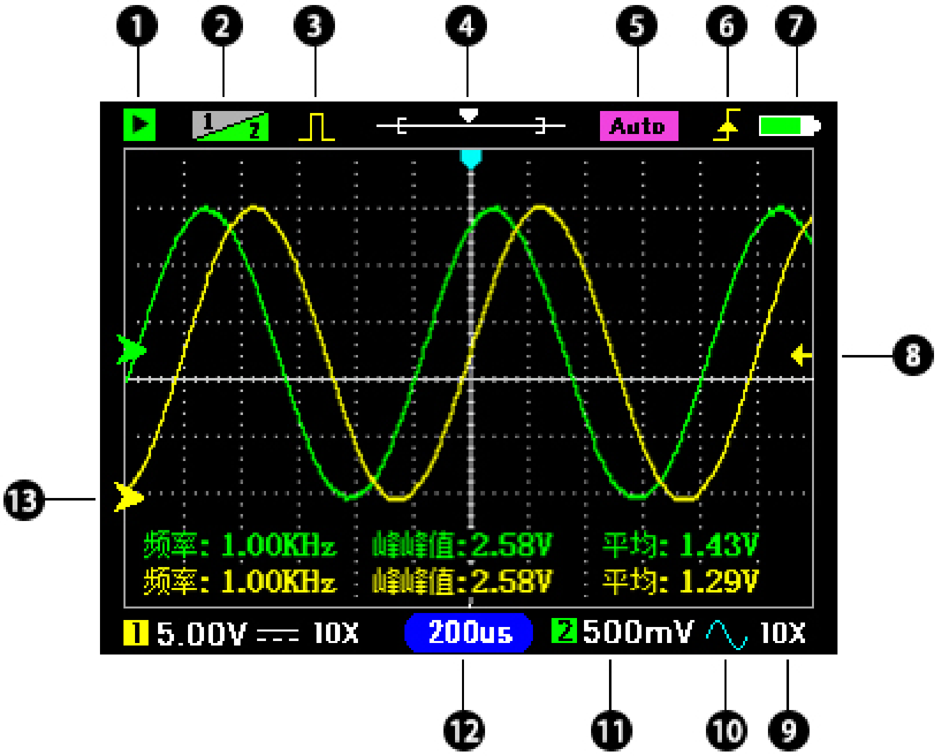
DSO3D12

DIGITAL OSCILLOSCOPE



User’s Manual

Designed by ZEEWEII



① Green is the running state; Flashing cyan for waiting to trigger; Red is stopped.
② Channel priority: Yellow 1 indicates that CH1 has high priority, and the CH1 waveform can be moved up or down.
③ Yellow: Turn on the signal generator output; Gray: Turns off the output.
④ Shows the position of the current time base window in memory.
⑤ Auto indicates that the trigger mode is automatic. Normal indicates that the trigger mode is normal.
⑥ Trigger edge: Rising edge trigger or falling edge trigger.
⑦ Battery level indication.
⑧ Trigger level position.
⑨ X1/X10 indicates probe attenuation, which should be set to match the probe. The goal is to tell the oscilloscope what attenuated probe you used.
⑩ DC/AC coupling.
⑾ Vertical sensitivity: Indicates the voltage of a grid.
⑿ Timebase: The time of a grid.
⒀ Zero arrow: The baseline position, where the vertical voltage is zero.

Note: (CH2 icon is gray to indicate that it is off, if you do not need to test two signals at the same time, please close CH2 to obtain higher sampling rate and reduce power consumption).

Buttons Function

1. Default function (function on button)

OK **Auto**	1. When the menu opens, as the OK button. 2. as an "Auto" button
Stop	Run / Stop
Single	Single trigger
AC/DC	Switch DC/AC coupling（**CH1**）
CH1/CH2	Change the CH1/CH2 priority
Menu	Open/close the menu
Shift↑	When this button is pressed, the functions on the case will be performed.
x1x10	Probe attenuation, which tells the oscilloscope what probe range you are using. (CH1)
Gen	Turn on/off the signal generator interface
Save	Save a screenshot of the waveform
50%	Quick centering (CH1)
DMM	Turn the multimeter on/off. (Press Shift+DMM to full screen)
Select	Multimeter function selection
mV/V	Adjust vertical sensitivity (voltage of one grid)
s/ns	Adjust the time base (the time of one grid)

2. Second function(Shift + other buttons)

Auto2	Enter real-time auto (CH1 only). Press any key to exit.
Zoom	Turn on/off zoom mode.
Ref	Reference waveform, the current waveform is locked to the screen as a reference.
AC/DC	Switch DC/AC Coupling (CH2).
CH2	Open/close CH2.
TgMode	Change trigger mode: Auto / Normal.
x1x10	Probe attenuation, which tells the oscilloscope what probe range you are using. (CH2)
TgEdge	Change the trigger edge: rising edge/falling edge.
View	View waveform screenshots

50%	Quick centering (CH2)
Full	The multimeter is displayed in full screen
Tg1/2	Switch trigger source: Ch1 / CH2

Note:

CH1 cannot be turned off, CH2 can be turned on or off. When two channels are not required, CH2 should be turned off for higher sample rates and reduced power consumption.

About trigger levels:

The small arrow on the right side of the screen is yellow to indicate that the trigger source is CH1, and green indicates that the trigger source is CH2.

The default trigger level is automatic adjustment, if you need to adjust it manually, you need to set the trigger level to "manual" in the menu, you can adjust the trigger level position arbitrarily (click the Shift key to move the trigger level up and down).

Auto2: RtAuto appears in the upper right corner of the screen, indicating real-time automatic adjustment. When the probe is connected, the oscilloscope automatically adjusts the range in real time. Press any key to exit.

Turn off the signal generator when you don't need it, which can slightly reduce power consumption.

1 Safety Precautions

- **High voltage. The x10 range of the probe measures up to 220V. An x100 probe is required for overreach.**
- **Probe attenuation. Before measuring voltages greater than 40V, switch the probe to the X10 position.**
- **Charge. The charging voltage is 5V, use a computer or mobile phone charger.**
- **When measuring high-voltage or non-isolated circuits, it cannot be used while charging (powered by a built-in battery).**
- **Do not use a multimeter while charging.**
- **Never insert the red probe into the current hole to measure the voltage, it will blow the fuse or even damage the machine. After measuring the current, remember to change the red probe to the voltage hole, remember!!**
- **When the multimeter measurement current is greater than 6A, the duration should not exceed 10 seconds to avoid line damage caused by heating.**
- **When measuring high voltages, do not use the oscilloscope and multimeter at the same time.**

2 Quick start instructions

2.1 Power

Press and hold the power button on/off.

When the battery is dead, use the USB cable to connect to the 5V adapter for charging, and the charging current is about 700mA. It is best to use a computer or mobile phone for charging. The LED lights up red when charging, and turns green when fully charged.

2.2 Auto

After the probe is connected to the signal, press the [Auto] button, and the oscilloscope will automatically detect the signal and adjust the range. If there is no waveform, the probe may not be connected correctly, or there may be no signal at the connection (you can use a multimeter to determine if there is a voltage).

2.3 Sensitivity and time base

Manual adjustment: "mV"/ "V" buttons scale the waveform vertically. The "s"/ "ns" button scales the waveform horizontally.

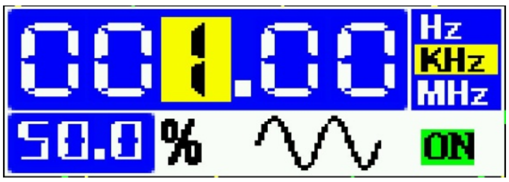
The vertical sensitivity indicates the voltage of a grid in the vertical direction, and it is adjusted by the mV and V buttons to adapt to different voltages.

The time base represents the time of a grid horizontally. It is adjusted by the S and NS buttons to accommodate different frequencies.

2.4 Test built-in signal generator

1. Connect the probe to the generator output pin. 2. Press the [Gen] key to open the generator interface, and then press the [Stop] key to change the generator to the [ON] state. Press the [ns] key to switch waveforms. Press the [Single] key to reset to 1.00Khz. 3. Press [OK] to exit the interface.

4. After pressing the [Auto] key, you can see the waveform of the generator.



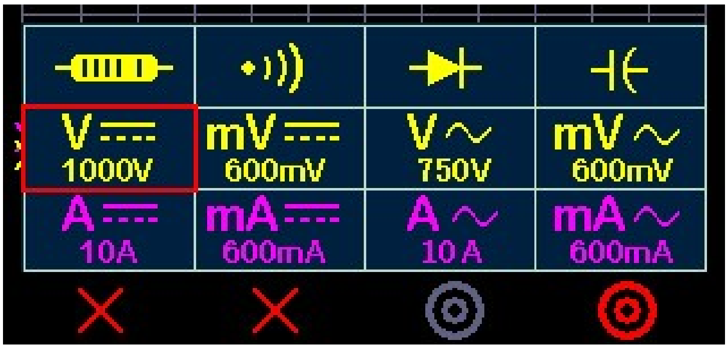
2.5 Use of Multimeters

Check the red pen first in the voltage hole. Press the [Select] key to open the

multimeter function table, select the function and press the [OK] key.

If you want to measure the current, insert the red pen into the current hole, and pay attention to the "**series**" of the meter pen and the power line.

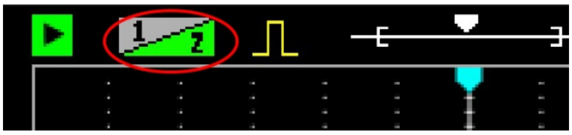
When charging: Multimeter is not supported, and the oscilloscope cannot measure high voltage or non-isolated circuits.



2.6 Use dual channels

Press the [Shift] key, and then press the [CH1/CH2] key to open/close channel 2. The default up and down keys move the channel 1 waveform, if you need to move the channel 2 waveform, you can press [CH1/CH2] to set the high priority of channel 2 (pay attention to the change of the 1/2 icon in the upper left corner).

When not using dual channel measurements, Channel 2 should be turned off for higher sample rates and reduced power consumption.



3 Probes

3.1 Probe calibration

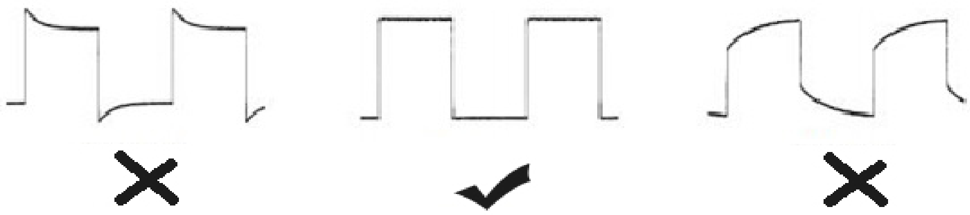
The probes delivered with this machine have been compensated. If you use another new probe before the first use, it must be calibrated before it can be used normally, otherwise the measurement will be inaccurate (only for the 10X/100X). The calibration method is as follows:

1. Switch the probe to X10.
2. Connect the probe to a 1KHz square wave with an amplitude of about 2V-3V. You can use the built-in generator.
3. Adjust the horizontal and vertical scales of the oscilloscope so that the waveform

is displayed stably at a suitable position on the screen.

4. Use a screwdriver to rotate the adjustable capacitor on the probe until you get the waveform in the middle of the figure below. The left and right waveforms below are references for incorrect calibration.





3.2 Probe bandwidth

Because the 1X probe has a large input capacitance, the bandwidth of the 1X is usually within 5MHz; while the bandwidth of the 10X is the standard bandwidth of the probe.

3.3 Probe withstand voltage

The maximum withstand voltage of the probe is generally marked on the probe, which is usually 600Vpk-pk.

3.4 Use tips

3.4.1 Large input capacitance

Because the probe 1X has a large input capacitance (usually more than 100 pf), it is not suitable for measuring some capacitively sensitive circuits. For example, when measuring a passive crystal of MCU, the large capacitor may cause the crystal to fail to vibrate. As for the output of a high-speed op amp, a capacitive load may cause the op amp to overshoot or oscillate. For circuits with large capacitances that are not suitable for measurement, please use 10X. The input capacitance of the 10X is usually several pf.

3.4.2 Measuring high voltage

The oscilloscope's measurement voltage range is -40V ~ + 40V (80Vpp). Please use the 10X probe to attenuate the signal by 10 times beyond this range. The measurable voltage range of 10X range is 600V(DC+AC). Please note that you must

first switch the probe to the 10X position before connecting the high voltage signal, otherwise the high voltage may break down the internal circuit of the oscilloscope.

3.4.3 High bandwidth

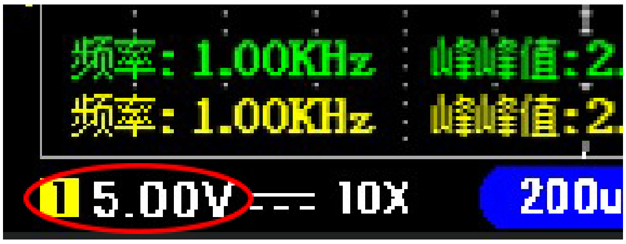
Because the 1X probe has a large input capacitance, the bandwidth of the probe 1X is usually within 5MHz, so please use the 10X position when the measured signal bandwidth is greater than 5M.

Summary: **10X is usually used in most applications.**

4 Vertical system

4.1 Vertical sensitivity

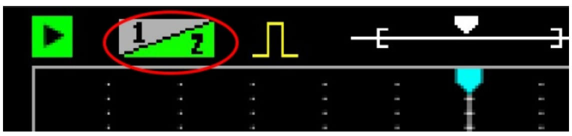
Oscilloscope vertical sensitivity refers to the voltage represented by a grid in the vertical direction of the screen. There are 8 divisions in the vertical direction of the oscilloscope. You can estimate the amplitude of the signal by observing how many divisions the waveform occupies on the screen. For example, if the vertical sensitivity is 1v/div, and the signal occupies 3 grids on the screen, you can know that the amplitude of the signal is 3V.



The scope's vertical sensitivity range is 10mV / div ~ 10V / div (1X probe). In the oscilloscope button panel, the keys for adjusting the vertical sensitivity are '**mV**' and '**V**' button. Pressing the 'mV' button decreases the vertical sensitivity, which is used to measure signals with smaller voltage amplitude. Press the 'V' button to increase the vertical sensitivity for measuring signals with larger voltage amplitudes.

4.2 Vertical position

How to move the waveform up and down: Press the up and down buttons directly to move the waveform up and down. The number in the upper left corner is yellow 1 for movable channel 1, click the "CH1/CH2" key to switch to green 2 movable channel 2.



5 Horizontal system

5.1 Time base

The time base refers to the time represented by each grid in the horizontal direction on the oscilloscope screen. There are 12 grids in the horizontal direction of the oscilloscope. The sampling time that can be observed on the screen = " time base" * 12.The user can estimate the signal period by observing how many grids a waveform period occupies. For example, the current time base is 500us, and one cycle of the signal occupies 2 grids,so the signal period is 1ms (1KHz).



The oscilloscope time base range is 5ns ~ 10s. The buttons for adjusting the time base in the oscilloscope button panel are '**ns**' and '**s**' button.， When observing high-frequency signals, you should press the 'ns' button to decrease the time base. When observing low-frequency signals, you should press the 's' button Increase the base.The time base in the figure is 200us/div.

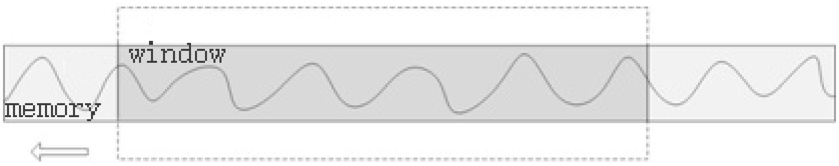
What you need to know is that the sampling process of the oscilloscope is:

"Sampling">>"Processing" >> "Display"

When adjusted to a large time base, the screen waveform refresh will be slow due to the longer time taken by the oscilloscope to sample the waveform.

5.2 Horizontally moving waveform

In the stop mode, the user can move the waveform left and right.



6 Trigger system

About trigger

The oscilloscope will capture a frame of waveform only after the waveform

meets the pre-set conditions. This action of capturing the waveform according to the conditions is the trigger.

What does trigger do?

1. Trigger can stabilize the waveform on the screen.
2. Capture the segment of the waveform you want to observe.

The trigger supported by the oscilloscope is edge trigger, including rising edge trigger and falling edge trigger.

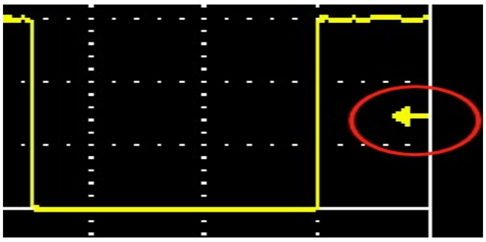
6.1 Trigger level

In the edge trigger mode, the trigger condition appears only when the waveform crosses up or down the trigger level.

The trigger level is automatically adjusted by default. Here's how to adjust manually:

a. In Menu-> Trigger, change "Trigger Level" to "Manual".

b. Press the “Shift” key, and then click the up and down keys to move the trigger level.



The arrow circled above is the trigger level position, and when the edge of the square wave in the above figure passes upwards through the position of this arrow, a trigger is formed (the waveform only forms a trigger when it crosses the trigger level up or down).

6.2 Trigger Sources

The small arrow on the right, yellow indicates that the trigger source is CH1, and other color indicates that the trigger source is CH2. Which channel is used as a trigger can stabilize the waveform of which channel, and two channels cannot be triggered at the same time.

6.3 Trigger Mode

Trigger mode: automatic trigger, normal trigger, single trigger. Automatic triggering is more commonly used. The normal trigger will not refresh the screen when there is no waveform, suitable for measuring some pulse signals that come occasionally, etc., and refresh the waveform once in a pulse. The single-trigger procedure is described in 7.2 below.

7 Operation Guide

7.1 50%

The role of 50% is to quickly return to the center, including zero point offset, trigger position, trigger level will quickly return to the middle position with one button, operation method: directly click "50%".

7.2 Single trigger

Suitable for sporadic single pulse capture.

A single trigger is when the single button is pressed, and the oscilloscope samples a frame of waveform and then stops. That is, only one frame of waveform is taken per press. It is important to note that this sampling must be triggered, if it is not triggered, the upper left corner of the oscilloscope flashes "||", and the sampling is not completed until there is a waveform trigger. To cancel a single trigger, click "Stop" to stop.

Procedure:

1. Connect the signal first.
2. mV/V set the voltage sensitivity, s/ns set the time base.
3. Set the trigger level to "manual" and adjust the trigger level (when you can't do it, see the previous section).
4. Press the Single key once.
5. The oscilloscope waits for the signal to arrive, and once a waveform crosses the trigger level, the oscilloscope completes a sample and then stops.

7.3 Screenshot

Click the "Save" button to capture the current screen.

7.4 View images

After pressing the Shift key, than press the Save key to enter the Image View window. In this window, the user can delete or browse historical screenshots.

Click the “x1x10” button to delete the current screenshots.

Click the "ok" button to zoom in on the waveform. After zooming in, click "ok" to return to the homepage.

Click the " Save " button to return to the oscilloscope window.

7.5 Signal generator

Click the " **Gen** " button to call up the window of the signal generator, The signal amplitude is 2.5V, the maximum frequency of the sine wave is 5M, and the other waves are 1M.

Click the " Stop" button to turn on/off the signal generator output.

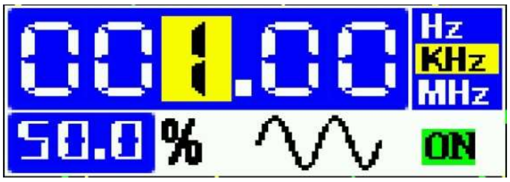
Click the "Single" button to reset the number to: 1.00Khz, 50%

Click the "s" and "ns" keys to switch the output waveform: sine wave, square wave, triangle wave, etc.

Click "Ok" or "Gen" to confirm and exit.

Square wave can adjust the duty cycle, other waveforms do not work.

Note: When the set frequency is greater than 1MHz, the square wave signal may show small horizontal jitter.



7.6 Single/dual channel

Shift” +"CH1CH2" button to turn on/off CH2. CH1 can only be turned on and cannot be turned off. When you do not need to use two channels at the same time, please turn off CH2 to obtain a higher sampling rate and reduce power consumption. When using dual channel mode, click the "CH1CH2" button to switch the priority of CH1 and CH2. If CH1 has a high priority, the waveform of CH1 is moved by the up and down buttons.

7.7 Cursor

Press the “Shift” +"s" key to turn the horizontal cursor on/off.

Press the “Shift” +"ns"key to turn the vertical cursor on/off.



Press the left and right arrow keys directly to move the horizontal cursor 1. After pressing the Shift key, press the horizontal arrow key again to move the horizontal cursor 2. The same goes for vertical cursors.

For vertical cursors, Y1: The voltage at the dashed line above. Y2: The voltage at the dashed line below. dY=Y1-Y2, which is the voltage difference between the two

dashed lines. The vertical (voltage) cursor can only measure one channel, and whichever channel has the highest priority, measure the voltage of which channel.

8 Menu introduction

8.1 Channel

The channel menu includes two options, "Coupling" and "Probe".

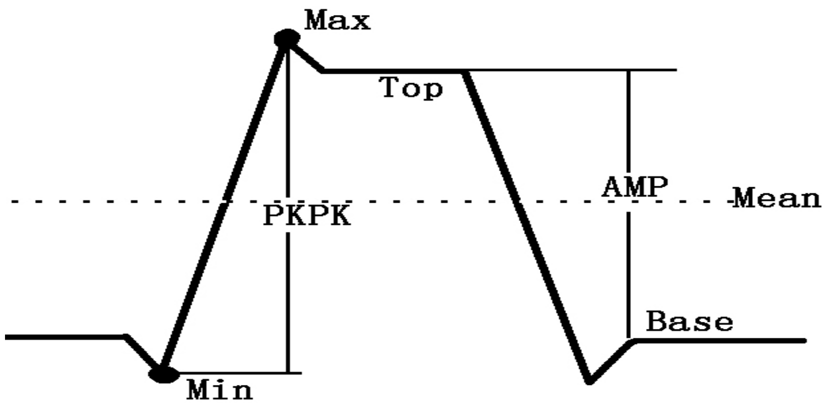
The coupling can be set "DC coupling" and "AC coupling". DC coupling passes the signal directly. AC coupling is equivalent to series connection with the capacitor.

Probes are available in " 1X" / "10X"/ "100X", this option corresponds to the oscilloscope probe. When the probe is switched to the 10X position, this option should be selected as " 10X". The same goes for the 1X.

8.2 Measurement

There are 14 measurement options available, as shown below:

Frequency, Peak-to-Peak, Duty cycle, Amplitude, RMS, Average, Period, +Pulse width, -Pulse width, Max, Min,Top, Base, -Duty cycle.



The difference between peak-to-peak and amplitude(AMP) is shown in the figure above.

8.3 Trigger

There are four options in the trigger menu: “Trigger Mode” ,“Trigger Type” , “Trigger level”and “Trigger source”.

Trigger Mode can be selected from "Auto" and "Normal".

For “**Auto**” mode, if a waveform trigger is detected, the waveform will be used for triggering. At this time, the waveform can be displayed stably. If the oscilloscope cannot detect the trigger condition, it will automatically force the trigger to display the waveform, but because there is no suitable trigger condition, the waveform will not be displayed steadily.

For “**Normal**” mode, The oscilloscope will not refresh the display until there is a waveform trigger. Therefore, in this mode, the screen waveform may not refresh or there is no waveform. It is suitable for measuring discontinuous waveforms and requires users to adjust the trigger level in advance.

Trigger type includes rising and falling edges. Rising edge trigger means that the waveform crosses the trigger level line upward, and a trigger condition occurs.

Trigger level include "automatic" and "manual".

"Auto" is suitable for trigger mode = auto, the oscilloscope detects the waveform in real time and automatically adjusts the trigger level.

"Manual" When the “single” is used or the trigger mode is "Normal", the "Manual" option should be used. Under this option, the trigger level can be manually adjusted by the user.

Trigger source indicates which channel's waveform is currently used for triggering. In the dual-channel mode, CH1 or CH2 can be selected. If the channel is used as the trigger source, its waveform can be stable. If the waveform frequencies of the two channels are different, the waveform of the other channel will be unstable.

8.4 Display

“**Persistence**” is to make the historical waveform remain on the screen for a while and then disappear. Optional persistence options are: None, 1s, Infinite. When Infinity is selected, the waveforms that have appeared on the screen will remain forever and will not disappear.

“**roll**” is to display the waveform while sampling. Only when the time base is greater than or equal to 200ms will the roll mode be entered. If roll is turned off, the waveform will be displayed after one screen is sampled, resulting in a long time before the screen is refreshed for large time base.

“XY” mode is a way that channel 1 is used as the X axis and channel 2 is displayed on the Y axis. It can be used to view Lissajous graphics etc.

"**Hi-rate**" refers to the waveform refresh speed. When turned on, many frame waveforms will be superimposed. When turned off, only one waveform is displayed at a time. Note that it is always “on” when the time base <=200ns.

8.5 Settings

When the FFT option is turned on, the CH1 waveform can be FFT calculated and displayed. FFT display options are: logarithmic, linear, and music spectrum. Measuring FFT results is not supported.

The calibration option is used to calibrate the zero point of the oscilloscope. Self-calibration is required when the outside temperature changes or when there is a zero offset due to aging. Remove the probes before calibration.

Furthermore:

1. In the settings, you can set whether to automatically shut down, if you choose

automatic shutdown, the oscilloscope will automatically shut down 15 minutes after no key operation.

2. You can choose whether to turn on sound or not.

3. Choice of language: Chinese or English.

4. Keep this menu open, and long press "s" to switch the background color of the measurement item.

5. Keep this menu open, and long press "ok" to reset the oscilloscope settings.

Parameters

Model	DSO3D12	Coupling	AC/DC
Channels	2	AUTO	Support
Screen size	3.2inch	Measurement	14 types
Sampling rate	250Msa/s	DC Offest	±2%
Bandwidth	120M	XY mode	Support
Equivalent sample	500M	Screenshot	Support
Rise time	<3ns	Frequency	±0.01%
Storage depth	128K	Single	Support
Impedance	1MΩ	FFT	Support
Time base	5ns – 10s	Wave out amp	2.5V±0.05
Ver sensitivity	10mV/div-10V/div	Wave out freq	5MHz(sin) 1MHz(other)
Max voltae	±40V（x1） ±400V（x10）	Shell size	width*hight* thickness 145*86*33mm
Trigger mode	Auto/Normal/Single	Language	CN/EN
Trigger type	rise/fall	Charger	TYPE-C / 5V
Display mode	YT / Roll	Charge current	700mA
Persistence	None/1s / ∞	Weight	266g

Multimeter parameters

Function	Range	precision
DC Voltage	600mV/6.00V/60.0V/600V/750	±(0.5%+3)
AC Voltage	600mV/6.00V/60.0V/600V	±(1%+3)
DC Current	600mA / 10A	±(2%+5)
AC Current	600mA / 10A	±(3%+5)
Pay attention：600mA hole with 1A fuse, 10A hole without fuse		
Resistance	600.0Ω	±(1.5%+3)
	6.000kΩ/60.00kΩ/600.0kΩ	±(1%+3)
	6.000MΩ	±(1.5%+5)
	60.00MΩ	±(3%+3)
Capacitance	60.00nF/600.0nF/6.000μF	±(10%+5)
	60.00μF/600.0μF	±(15%+5)
Diode	0.0V︵3.3V，Display “OL” above 3.3V	
Continuity	Sound at 50Ω and below	

Fast calibration：

If you have a higher accuracy multimeter "ZZ" and you want dso3d12 to get higher accuracy, the following calibration steps can help you:

a. Enter dmm full-screen mode and select DC1000V. dso3d12 and "ZZ" measure the same voltage.

b. Quickly click the button "50%->50%->Save" to enter the calibration mode, press the up and down keys to adjust the value until the value is the same as the "ZZ" meter. Click "OK" to confirm and exit.

The same steps are followed for resistor, diode, capacitor, current, and mV functions. AC parameters are the same as DC and do not require separate calibration.

Q & A

0. I am a beginner, how do I reset the device to its initial state?

Answer: Open Menu->Set, and then long press the "Auto" button to reset.

1. What is the difference between probe 1X and 10X?

Answer: The 1X does not attenuate the signal, and the 10X attenuates the signal amplitude by 10 times. When the measuring voltage is higher than 40V, 10X is used. In addition, the bandwidth of 1X file can only reach about 5M. <u>So generally we usually use 10X</u>, and use 1X when the measured signal amplitude is less than a few hundred millivolts. Note: If the probe test lead is set to 10X, it must be set to 10X in the menu. 1X is the same. That is to keep the two consistent! !

2.When the timeBase is >50ms, the waveform refresh becomes slower?

Answer: The time base of 50ms means the time of "one grid". There are 12 grids in the horizontal direction. The time to perform one sampling=50*12=600ms, so it is normal for the waveform refresh to be slow.

3.How to measure DC power voltage?

Answer: First, set the coupling to "DC", and adjust the probe to the 10X position (the oscilloscope menu should also be set to the same 10X as the probe). Connect the probe to the power output terminal, and then click the [Auto] key. Pay attention to the "Mean" value.

4.How to measure 220V mains?

Answer: First remove the USB cable (isolation), then adjust the probe to the 10X position, adjust the vertical sensitivity to 100V, and adjust the time base to 10ms, and then connect the probe to the neutral wire and the live wire (be careful!).

5.How to measure audio signal?

Answer: The coupling mode is set to "AC". The probe is set to the 10X position. The probe is connected to the audio output. The time base is adjusted to about 1-10ms, and the voltage sensitivity is adjusted to about 500mV (decided according to the volume).

6.How to measure main board communication signal or bus signal?

Answer: The probe is connected to the signal first. The coupling mode is set to DC, the probe is set to the X10 position (the menu should also be set to 10X), and then click the [Auto] button. If the correct waveform cannot be obtained, please manually click the [s]/[ns] button to adjust the time base.

7.How to measure power supply ripple?

Answer: Set the coupling mode to "AC" in the menu, and set the probe to the 1X position (the menu is also set to 1X). Adjust the time base to about 200us. First adjust the vertical sensitivity to 10mV. If the waveform exceeds the screen, click the [V] key to reduce it until all the ripples appear on the screen.